Preferred viewing locations: A validation and an extension

Given the important points this paper raises, the influential data it presents along with the theoretical questions against which the data are considered, it is probably clear why I am not surprised that Rayner's article is so widely cited.

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Preferred viewing locations: A validation and an extension

Rayner (1979) established the Preferred Viewing Location (PVL) for reading fixations: typically, readers fixate at a location slightly left of word centre. Despite its simple elegance, the design of figure 2 of this citation classic has not become a standard for illustrating this phenomenon. We like to pay tribute to this core result (and its visualisation) with a cross-language validation of the PVL. We also extend our analysis to include PVLs of forward and backward refixations and use the new results to qualify proposals of refixation preprogramming.

PVL validation

We analysed landing-position data from 226 German readers (age range: 16 to 84 years) of the Potsdam Sentence Corpus (Kliegl et al 2006). Our figure 1 shows median fixation points[(2)] for single fixations following forward movements (figure 1a), and single fixations following inter-word regressions (figure 1b). For forward single fixations, the German data are very similar to the original English data. Median fixation positions are close to word centre with a slight leftward shift increasing with word length. Differences emerge, however, for regressive saccades. For most word lengths, median fixation position is close to word centre, with a slight shift towards the end of words for longer words (see also Radach and McConkie 1998). In contrast, the English data showed a stronger tendency for inter-word regressive saccades to land towards the end of the word (Rayner 1979).

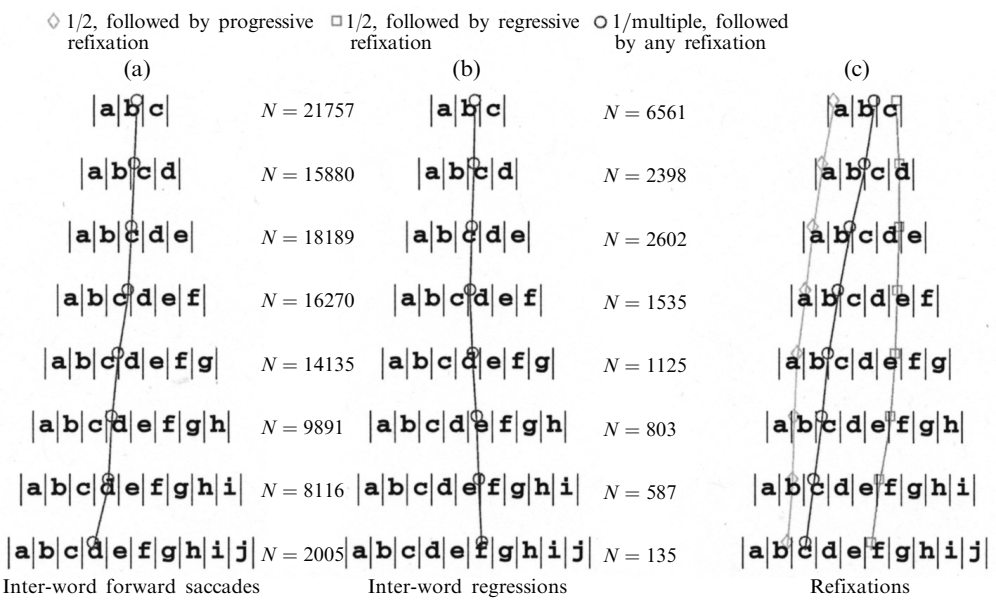

Figure 1. Median landing positions: (a) for single fixations following inter-word forward saccades; (b) for single fixations following inter-word regressive saccades; and (c) for different types of refixation cases.

[(2)] As in Rayner (1979), fixations on the space sign in front of the word were excluded from analyses.

PVL in refixations

Figure 1c additionally shows data for refixation saccades. When considering all initial fixations that are followed by a refixation, there is only a very small, though still systematic, influence of word length on median initial landing position which is around the second letter position (figure 1c, circles), replicating McDonald and Shillcock (2004). landing position close to word centre in single-fixation classes is interpreted as an argument in favour of the so-called preprogramming hypothesis of refixation saccades (McDonald and Shillcock 2004). However, the present analyses show that this constant landing position at the second letter disappears when progressive refixations (diamonds) and regressive refixations (squares) are considered separately (though restricted to 2-fixation-cases in the present analysis). Thus, constant landing positions for refixations are not a strong argument in favour of the refixation preprogramming hypothesis.

Other current applications

McConkie et al (1988) expanded upon PVL, arguing that the considerable variance in landing positions within words is due to systematic and random oculomotor error. These errors in saccade programming may lead to mislocated fixations, ie fixations on unintended words. With recent work, we provided an algorithm to estimate the proportion of mislocated fixations from empirical data (Nuthmann et al 2005). In addition, we identified mislocated fixations as a main factor contributing to the 'inverted-optimal viewing position' effect for fixation durations (Nuthmann et al 2005, 2007) and validated the underlying assumptions with the SWIFT model (Engbert et al 2005). In summary, PVL has enjoyed a venerable history; it is bound to stay around as a key result of reading fixations.

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Fixation locations within words

Rayner (1979) demonstrated longer saccades into longer words, giving rise to the suggestion of a 'preferred viewing location' whereby readers seek to fixate a location in the word that will facilitate recognition and optimise the reading process. Furthermore, the length of the word currently being fixated also influences the landing position. The significance of the results was substantial at the time, in that it helped distinguish between two main hypotheses of eye-movement control. Our eyes do not move along a line of text with reasonably constant saccadic amplitude, varying only when comprehension